This document contains
6 pages.

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PAR 252

Improvement of Precision Enlarger Fluid Injection System

28 April 1969

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PROJECT AUTHORIZATION REQUEST

PAR 252
28 Apr 69

SUBJECT: Improvement of the Precision Enlarger Fluid Injection System

TASK/PROBLEM

1. Develop, fabricate, test, and evaluate an improved fluid-injection-system breadboard that will be compatible with the fluid-gate requirements of both the [redacted] Precision Enlarger (BPE) and 10-20-40X Precision Enlargers.

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PROPOSAL

2. Introduction. During the past few years, Precision Enlargers used in the field have experienced certain failures in the system used to inject refractive index matching fluid into the negative gate. These failures prompted the search for an improved system. As a result, a wide variety of fluid moving methods were considered as well as the problem of controlling the fluid volume delivered. Two objectives were: (1) to obtain a system that would be highly resistant to the chemical properties of commonly used fluids of the chlorinated hydrocarbon type, and (2) to provide rapid efficient delivery of fluid to the point of application.

3. Establishment of Design Goals. An ideal fluid injection system should have the following characteristics and capabilities:

a. Relatively inexpensive to manufacture.

b. Reliable and mechanically simple.

c. Highly resistant to chemical attack by the fluid.

d. Simple to operate.

e. Adaptable to both the BPE and to the 10-20-40X Precision Enlargers.

f. Safe for operators to use.

g. Adjustable delivery volume.

h. Readily visible fluid supply level.

4. General Approach:

a. Of the methods that were considered for moving the fluid, a simple centrifugal pump appears to be the most desirable. Because such pumps contain no precision parts, they are economical to manufacture; in addition, lack of precision parts makes it possible to choose from a wider range of fabrication materials. As a result, the task of finding a pump material that resists chlorinated hydrocarbons is made easier.

b. Immersion of the pump in the fluid supply will render it self-priming. The use of a long shaft will keep the motor out of the fluid reservoir and eliminate the need for potentially troublesome seals. Electrical control of such a pump is relatively simple, and it can be fitted within a transparent or translucent reservoir, thus providing ready visibility of the fluid level. A schematic diagram of such a system is shown in Figure 1.

c. It is proposed that the volume of fluid delivered be metered by controlling the operating time of the pump. This can be accomplished electrically by such a device as the variable-time-delay relay. This approach is preferred because of its simplicity. It eliminates use of valves and permits the fluid lines and nozzles to drain back through the pump into the reservoir as does the present system. However, the possibility that valves might be desirable in the future was considered, and if suitable hardware is developed and offers advantages, this approach could be pursued.

5. Testing. To make testing and evaluation of the fluid injection system breadboard as meaningful as possible, it is planned to operate the pump for an extended period of time and to schedule complete operating cycles for the equipment. By setting the system up as a closed loop, a hundred or more cycles per hour on a 24-hour test schedule should be possible. This effort will determine the reliability of the design and its resistance to attack by the refractive index fluid.

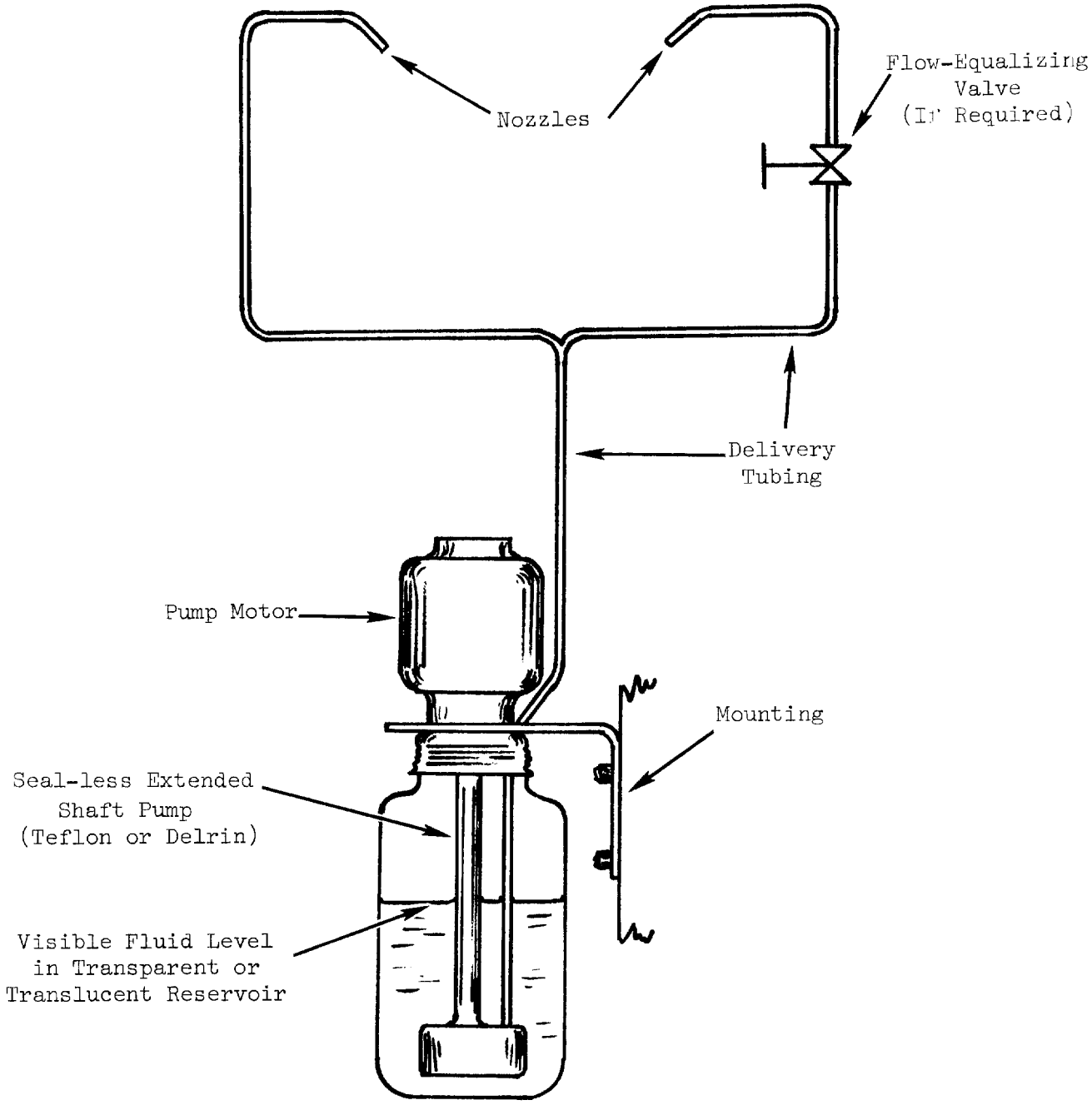

Figure 1. Proposed Centrifugal Pump System

PROGRAM OBJECTIVE

6. Develop a refractive-index fluid-injection system for use with the [redacted] and 10-20-40X Precision Enlargers that will prove more reliable, more economical to manufacture, and less subject to attack by the hydrocarbon fluids now used in these systems. STAT

7. If the system proves to be successful, it can then be incorporated in present and future designs of printers requiring liquid gates. At the time of its first production lot, kits could be made for retrofitting printers already in the field.

SCHEDULE

8. A tentative schedule covering the major phases of effort is shown in Figure 2. Changes in this schedule that may be necessary as the work progresses will be reviewed with the customer.

TENTATIVE SCHEDULE

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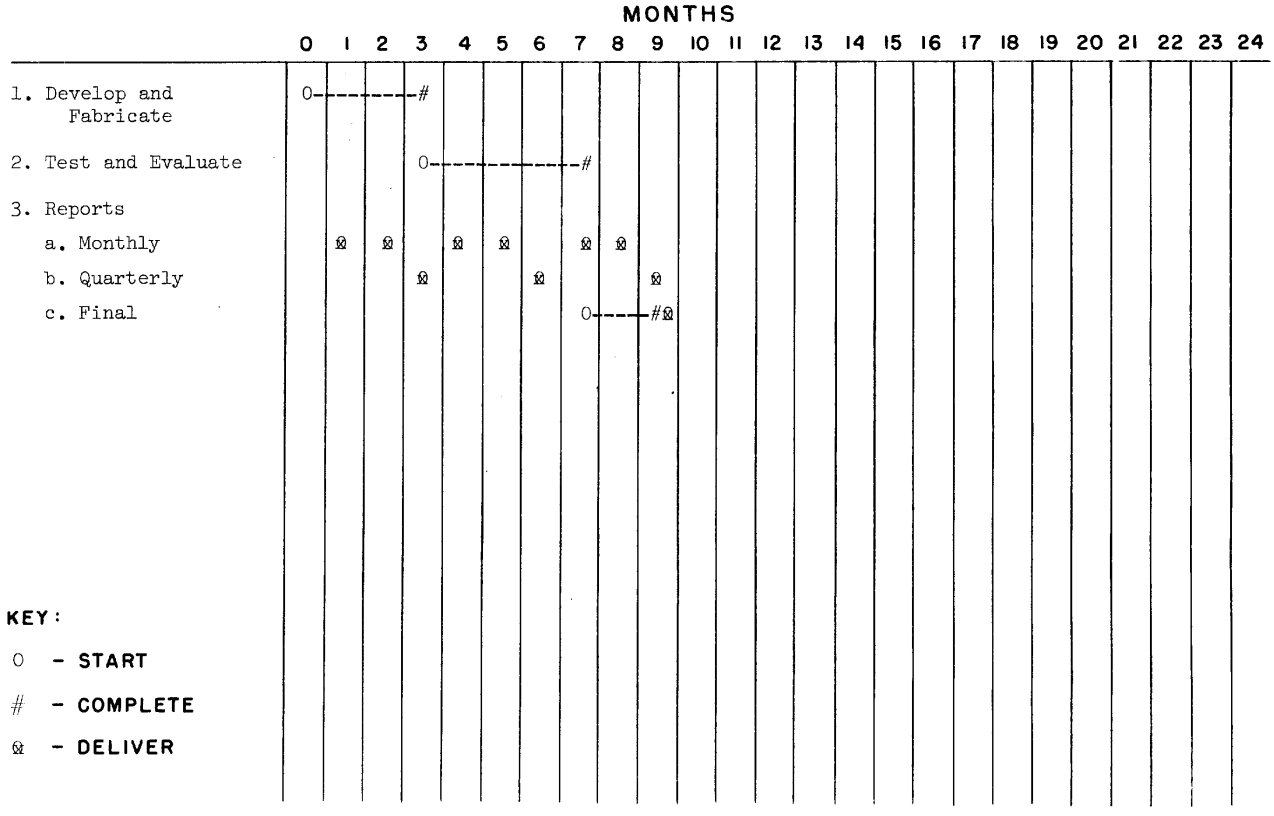

Figure 2